

# Memorandum

*Making Conservation  
a California Way of Life.*

**To:** MR. DAVID LAM  
ACTING BRANCH CHIEF  
DESIGN BRANCH C, DISTRICT 12

**Date:** December 22, 2017

**File:** 12-ORA-133-PM 3.1/R4.3  
EA: 12-0P94U0  
(1217000076)

**Attention:** MR. STEVEN LE, PROJECT ENGINEER

**From:** DEPARTMENT OF TRANSPORTATION  
DIVISION OF ENGINEERING SERVICES  
GEOTECHNICAL SERVICES  
OFFICE OF GEOTECHNICAL DESIGN SOUTH  
BRANCH C

**Subject:** PRELIMINARY GEOTECHNICAL ASSESSMENT FOR THE PROPOSED  
IMPROVEMENTS TO STATE ROUTE 133 (SR-133) FROM POST MILE 3.1 TO  
REVISED POST MILE 4.3

## INTRODUCTION

This memorandum provides a brief description of the preliminary geotechnical evaluation performed by the Office of Geotechnical Design South (OGDS), Branch C for the Initial Study/Environmental Assessment Phase of the subject project. The project proposes to improve the run-on/run-off of storm water and the traffic safety at SR-133 and also provide Class II bike lanes in both directions. Based on discussions with the Design Branch C of District 12 (Design Branch C), OGDS decided that a geotechnical evaluation based on the visual observations would be adequate for this phase of the project. Therefore, OGDS's scope of work for this phase of project was limited to evaluating site geotechnical conditions through visual observations, the review of pertinent literature and providing preliminary recommendations based on those information.

## PROJECT DESCRIPTION

Based on an email from Design Branch C, dated June 29, 2017, OGDS considers the main components of the project requiring geotechnical input are as follows.

- Construction of a retention basin at the interchange of State Route 73 (SR-73) and SR-133. The retention basin will be created by constructing an approximately 10-foot high concrete dam with appurtenances for the control of drainage.
- Extension of the existing 3-foot x 5-foot box culvert to match the proposed pavement width.
- South of El Toro Road Intersection, the proposed improvements call for providing a 12-foot wide continuous lane, a second 12-foot wide lane that drops at the standard taper and

a 10-foot wide shoulder in southbound SR-133. This will require the excavation into the existing ascending slope on the west side of the roadway. Design Branch C proposes to excavate the slope at the steepest possible angle in order to minimize the environmental impact and right-of-way acquisitions.

## **SITE TOPOGRAPHY AND SUBSURFACE CONDITIONS**

### **Site Topography**

At the location of the proposed retention basin, the topography consists of a trough-like area created by the construction of embankments of SR-133 and SR-73 roadways and the loop on-ramp from SR-133 to southbound (SB) SR-73. Column/shafts of SR-133-SB SR-73 connector bridge are located within the area of the proposed retention basin.

The topography at and south of El Toro Road Intersection consists of the relatively flat, paved surface of SR-133 roadway and the adjacent ascending slope. The slope is uneven and contains several valleys and relatively flat/gently sloping isolated areas that are underlain by alluvial soils or slope wash. In general, the gradient of the slope appears to be about 1 ½:1 (horizontal: vertical). However, at some locations, gradients steeper than 1:1 (horizontal: vertical) or even near-verticality was observed for slope segments of limited height.

### **Regional and Site Geology**

The project area is located in San Joaquin Hills within the Peninsular Ranges geomorphic province. The Peninsular Ranges Province is characterized by northwest-southeast trending mountain ranges and valleys that are parallel to the San Andreas Fault. The underlying geologic formations are mapped as Quaternary Alluvium, the Miocene-aged, marine, Topanga Formation (undifferentiated), and the Eocene- to Oligocene-aged Sespe Formation on the Geologic Map of Orange County (CGS, 1981). A landslide is also mapped near the southwest corner of SR-133/SR-73 Intersection.

The alluvium is expected to consist of a mixture of fine- and coarse-grained materials. Cobbles and boulders may be present. The southbound SR-73 off-ramp to SR-133 is generally where the underlying bedrock changes from Topanga Formation in the north to Sespe Formation in the south. The Topanga formation consists of sandstone and siltstone beds. The Sespe Formation consists predominantly of sandstones and conglomerates. The geologic structure and engineering properties of the underlying formations will require further characterization with a geotechnical investigation during the design phase.

### **Groundwater**

The Logs of Test Borings for SR-133/SR-73 Interchange (Reference 1) indicates that the depth to groundwater has varied from about 5 feet to more than 60 feet at the time of investigations (1990 to 1995). The borings show, that in general, the elevation of groundwater table has varied from about 270 feet to 280 feet.

No information on the depth to groundwater at El Toro Road Intersection is available from the Department of Water Resources' Water Data Library, or the State Water Resources Control Board's Geotracker websites.

A site-specific investigation will be conducted in the design phase to investigate the subsurface conditions including depth to groundwater.

## **PRELIMINARY SEISMIC HAZARD EVALUATION**

The controlling fault according to Caltrans' ARS on-line website version 2.3.09 is the San Joaquin Hills Fault, fault ID 376. The San Joaquin Hills Fault is a reverse fault dipping 23° to the west with a  $M_{max}$  of 7.0 and a rupture distance ( $R_{rup}$ ) of 4.2 km (2.6 miles). A  $V_{s30}$  of 350 m/s was used for a preliminary analysis of the seismicity for this project based on SPT and soft rock correlations averaged for the site. The peak ground acceleration is calculated to be roughly 0.7g. A site-specific analysis is required to be performed during the design phase when a more accurate estimate of the  $V_{s30}$  can be obtained from borings performed during a geotechnical investigation.

The project area is mapped as being susceptible to liquefaction by the California Geological Survey (Seismic Hazard Zones, Laguna Beach Quadrangle, 1998). The slopes south of El Toro Road Intersection are also mapped as being susceptible to seismically induced landsliding. However these preliminary observations should be verified during the design phase through a site-specific geotechnical investigation.

## **GEOTECHNICAL OBSERVATIONS AND PRELIMINARY EVALUATION**

The subsurface soils at the location of proposed concrete dam is likely to be alluvium. In order to found the dam on competent material, OGDS believes that overexcavation of alluvial soils would be necessary along the alignment of the dam. In addition, a cut-off trench or a grout curtain may also be necessary to mitigate seepage under the dam depending on the permeability of the subsurface soils. If bedrock units with fractures and joints exist at shallow depths, a grouting program to seal the fractures and joints may also be necessary.

At and south of El Toro Road Intersection, the ascending slope is mostly underlain by thinly bedded claystone and siltstone of Topanga Formation. In the site visits, we observed that though the slopes contain adversely oriented bedding there was little evidence of failures on the existing slope cuts. Based on observations, OGDS believes that the slope may be excavated at a ratio of about 1 ½:1(H:V) or steeper for the proposed construction. If adverse bedding conditions with weathered bedrock units are present, the slope could be reinforced with soil nails (without facing) to mitigate potentially unstable slope conditions. Slope segments less than 4 feet in height could be excavated at a slope ratio of 1:1 or steeper, depending on the availability of space. These

preliminary recommendations should be verified during the design phase by analyzing the stability of the slope under static and design seismic conditions.

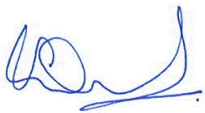
For the extension of the box culvert, it may be necessary to overexcavate the loose/soft subgrade soils, present along the alignment of the proposed extension. The depth of overexcavation could be on the order of 3 to 5 feet but should be determined based on a site specific investigation.

It should be noted that the above preliminary assessments were made based solely on visual observations without a detailed surface mapping or an identification of the exposed geologic units. Therefore, these assessments and mitigation measures should be further evaluated and the above conclusions and recommendations be verified through a site specific geotechnical investigation in the design phase.

Please call Gamini Weeratunga at (657) 328-6592 or Kristopher Barker at (909) 806-4701 with any questions you may have on this memorandum.

Prepared by:                      Date: 12/22/2017

Prepared by:                      Date: 12/22/2017



Gamini Weeratunga, G.E.  
Transportation Engineer  
Office of Geotechnical Design South  
Branch C



Kristopher Barker, C.E.G.  
Engineering Geologist  
Office of Geotechnical Design South  
Branch C

Cc: Ahmed Abou-Abdou-Project Manager, District 12  
Vanessa Ragland, -Project Engineer, District 12 Design  
Edward Dolan, Associate Environmental Planner, District 12  
Tim Lam- Senior Engineer, Office of Geotechnical Design South